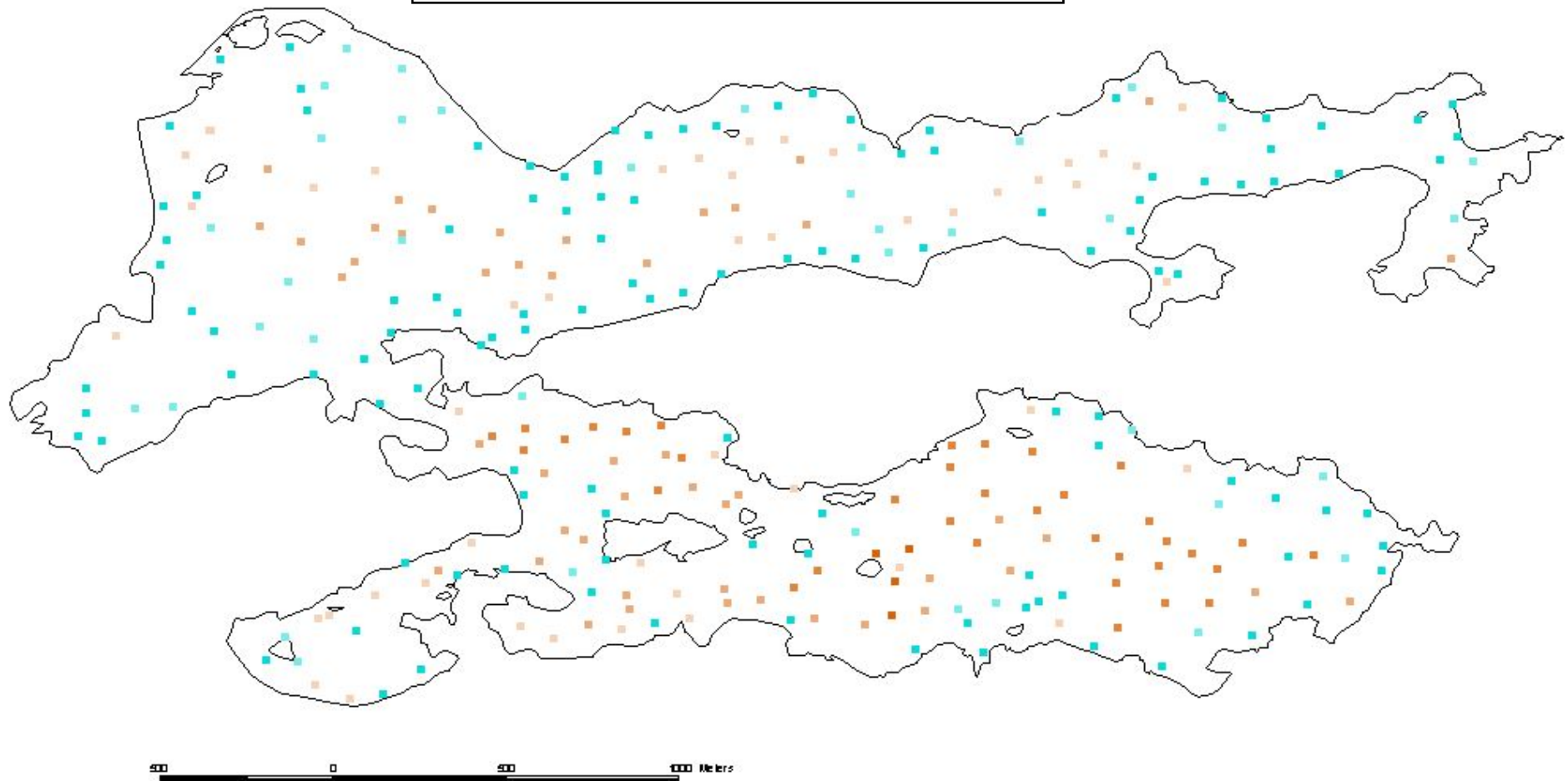


## Part 2, Timothy Drexler, U.S. EPA



Deer Lake: Spatial distribution of all sediment samples taken in 1998 and 2000. A total of 317 unique locations were sampled with 196 ponar samples and 121 cores, totaling 507 analyses (including duplicates).  
10 Jan. 01

### Maximum mercury concentration per sample location

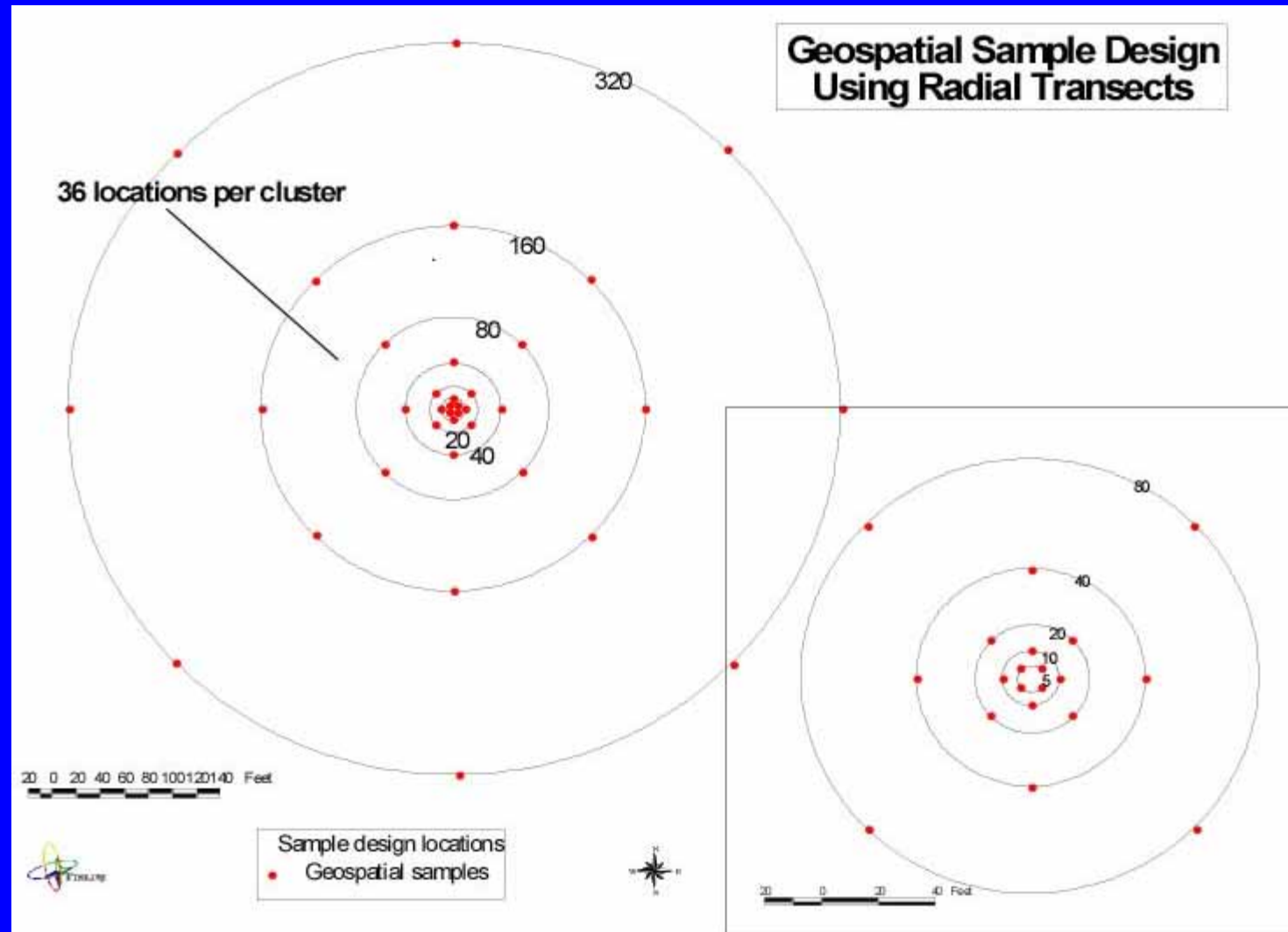
■ 0 - 1 ppm	■ 3 - 5 ppm
■ 1 - 2 ppm	■ 5 - 10 ppm
■ 2 - 3 ppm	■ 10 - 20 ppm
	■ 20 - 50 ppm



# Sample Spatial Correlation?

- Initial Sampling, Random or Grid
- Adaptive Cluster Sampling (EPA QA/G-5S)
- Generate semivariogram

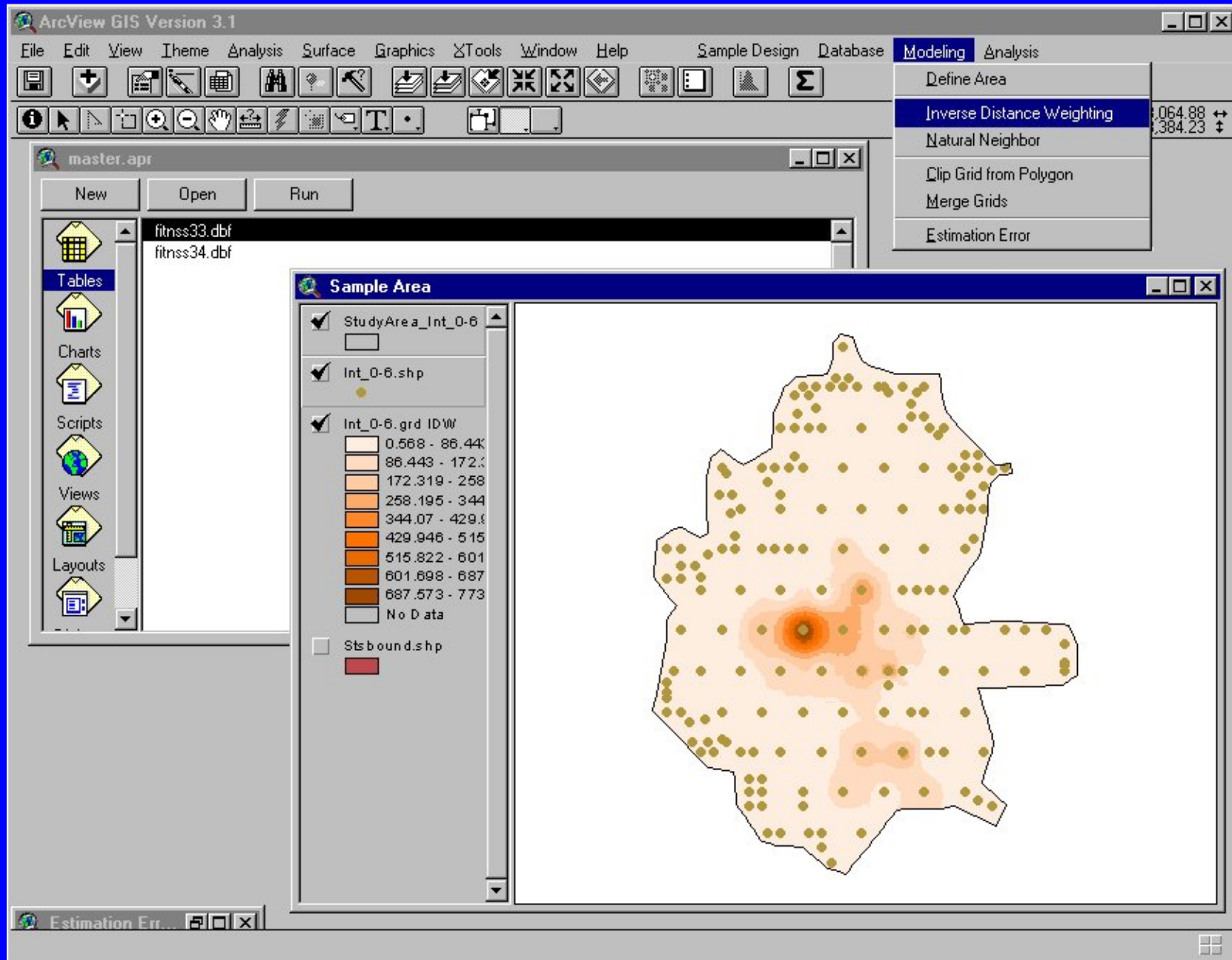
# Radial Cluster Sampling



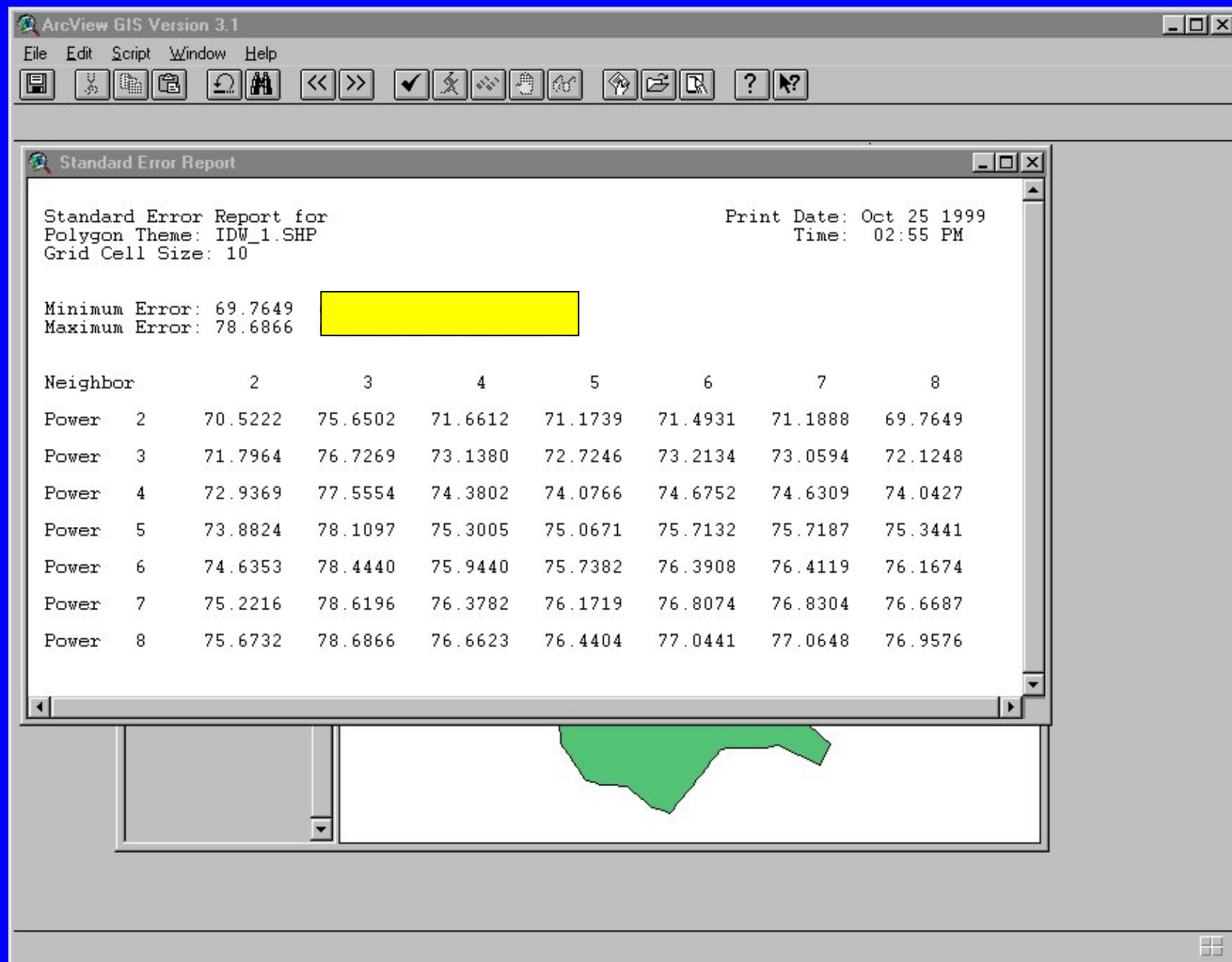
# Site Modeling

- Data Interpolation
- QA/QC (error estimation, cross validation, etc.)
- Mass and Volume Calculation
- Remediation Tools
- Report Generation

# Inverse Distance Weighting Interpolation



# Cross validation



# Mass and Volume Calculation

**Mass and Volume** [X]

Contamination by Interval

Select Interval Grids:  Concentration Units:

Top Depth:  Depth Units:

Bottom Depth:

Total Depth Grid:  Depth Units:

Concentration Ranges

Min Concentration:  Units:

Max Concentration:

Sediment/Soil Density

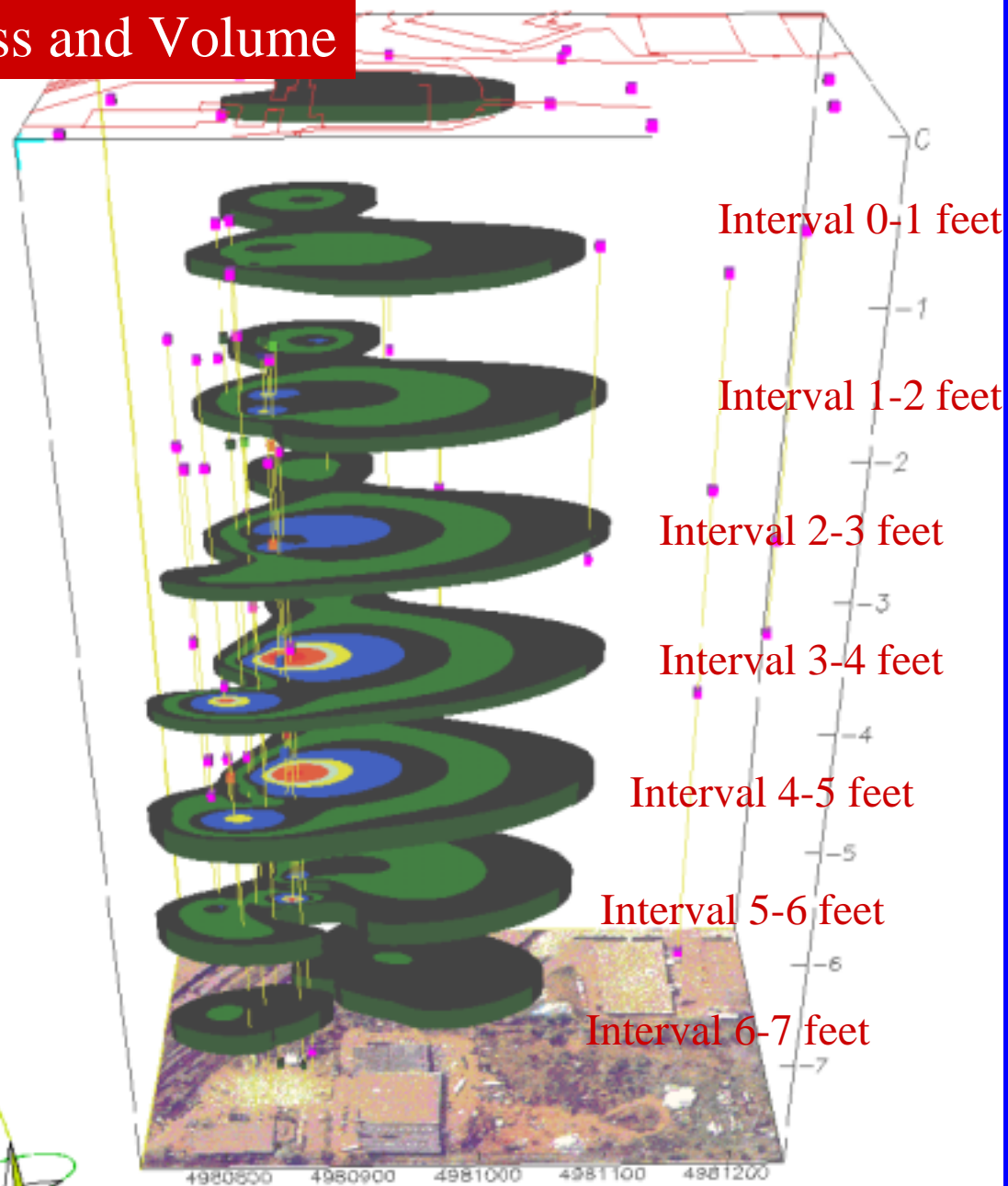
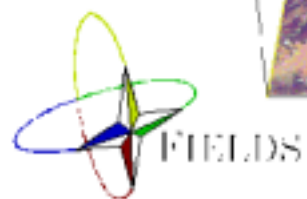
☒ Dry Density (lb/yd3)

☐ Wet Density (lb/yd3)

% Solids

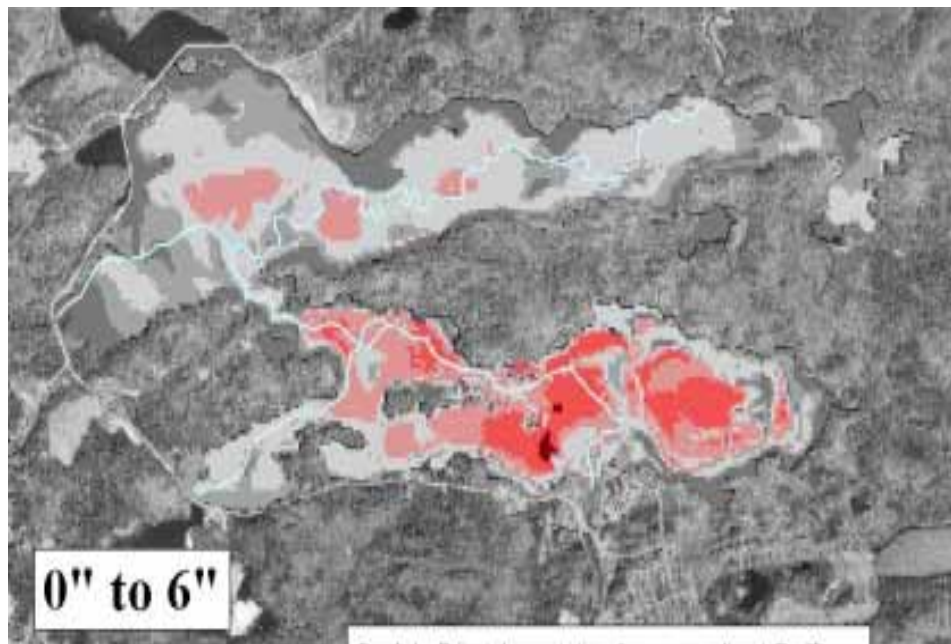


## Mass and Volume

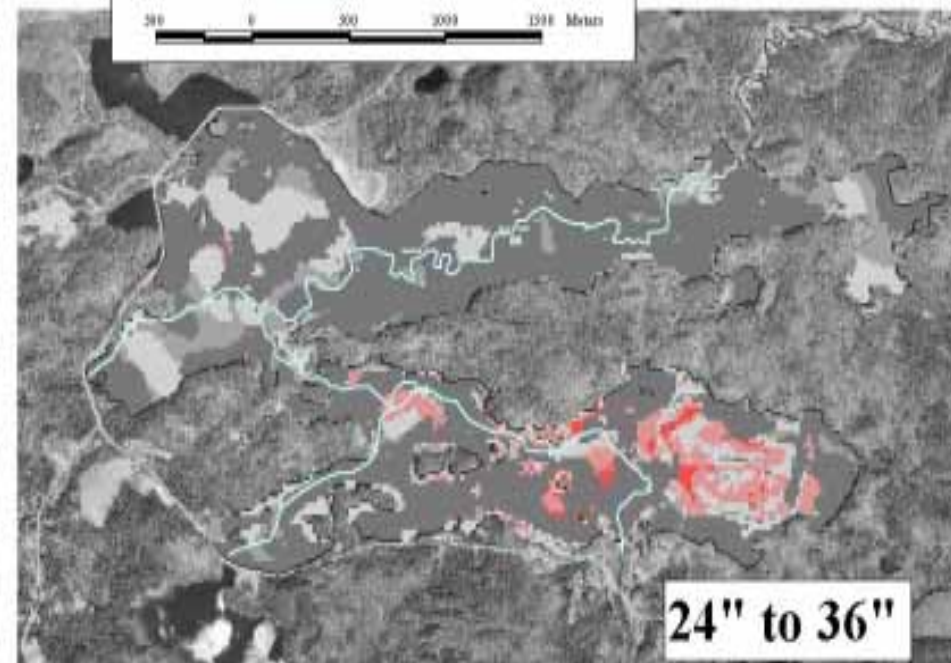
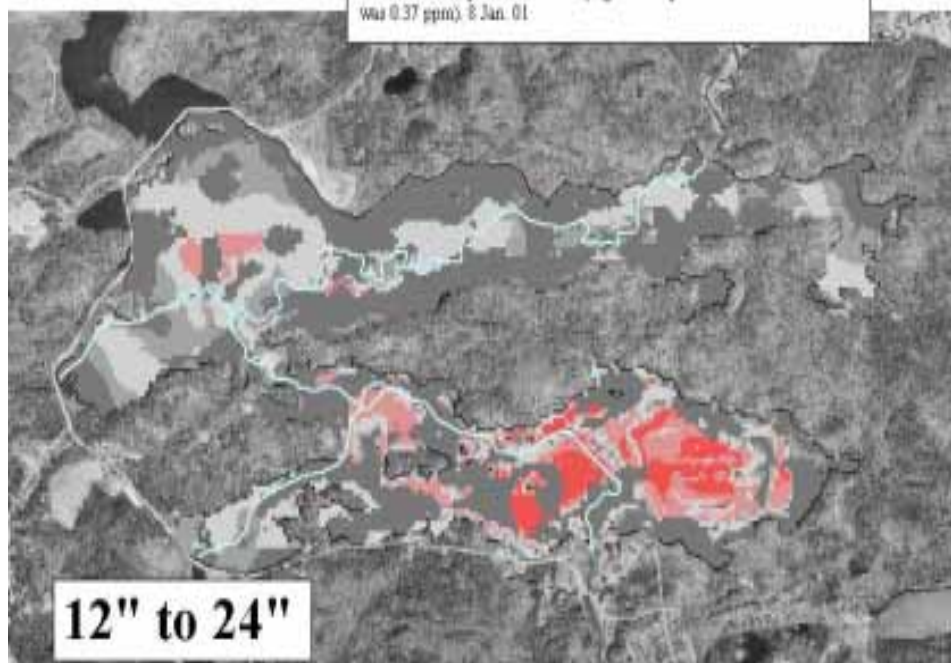
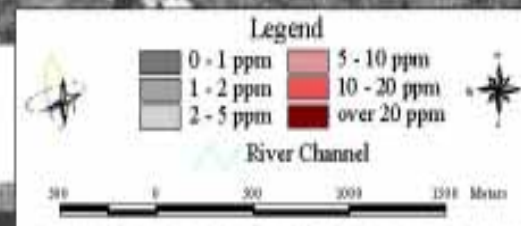
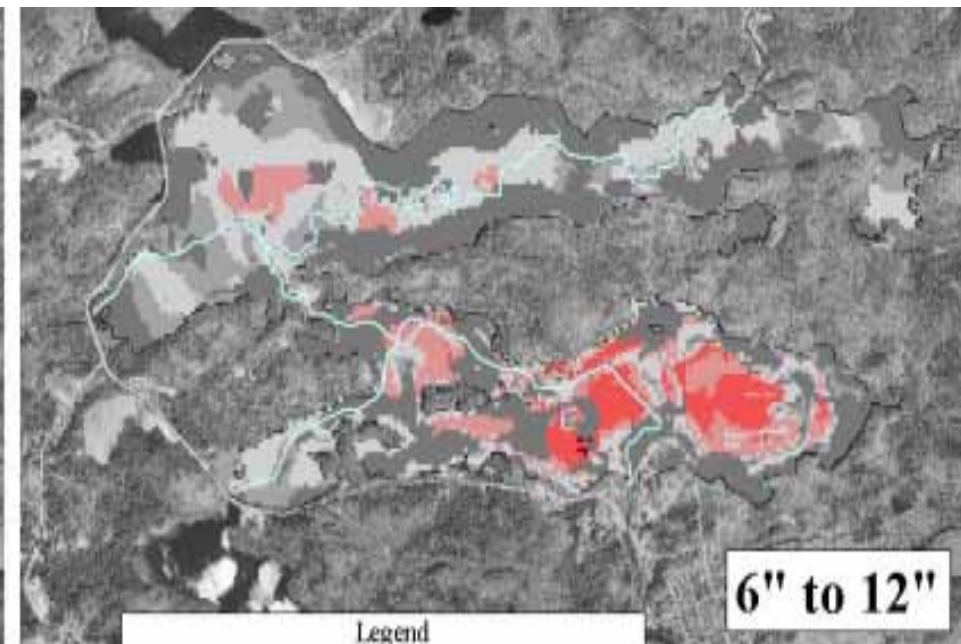


**Interpolated  
Concentration  
Intervals**





Deer Lake: Estimated concentration of mercury in sediment. The 3D interpolation was done using earthVision (Dynamic Graphics Inc) using 20x20 meter cell size. 0-6", 6-12", 12-24", 24-36" sediment layers were created by taking the maximum cell value for each layer from the 3D model. Sediment deeper than 36" were not found to have elevated mercury concentrations (highest sample concentration >36" was 0.37 ppm); 8 Jan. 01.



## MassVol Report

Mass / Volume Report

MASS-VOLUME REPORT for

Grid Themes:

Grid: "Grd 0-6" ( Bottom = "Bottom" )

Grid: "Int 18-30" ( Bottom = "Bottom" )

Grid: "Int 30-42" ( Bottom = "Bottom" )

Grid: "Int 42-46" ( Bottom = "Bottom" )

# Mass and Volume

Grid Name	Top Depth	Bottom Depth	Min. Conc.	Max. Conc.	Density	Volume (cu yd)	Mass (lbs)
Grd 0-6	0.000000	0.152400	0	1510	2500	25415.26842	1500.40556
Subtotals:						25415.26842	1500.40556
Int 18-30	0.457201	0.762002	0	1510	2500	29250.59895	4551.32706
Subtotals:						29250.59895	4551.32706
Int 30-42	0.762002	1.066800	0	1510	2500	1237.23278	519.05136
Subtotals:						1237.23278	519.05136
Int 42-46	1.066800	1.168400	0	1510	2500	17.03028	0.05748
Subtotals:						17.03028	0.05748
Int 6-18	0.152400	0.457201	0	1510	2500	50830.70360	5940.50213
Subtotals:						50830.70360	5940.50213
GRAND TOTAL						106750.83402	12511.34360

Print

Save Text

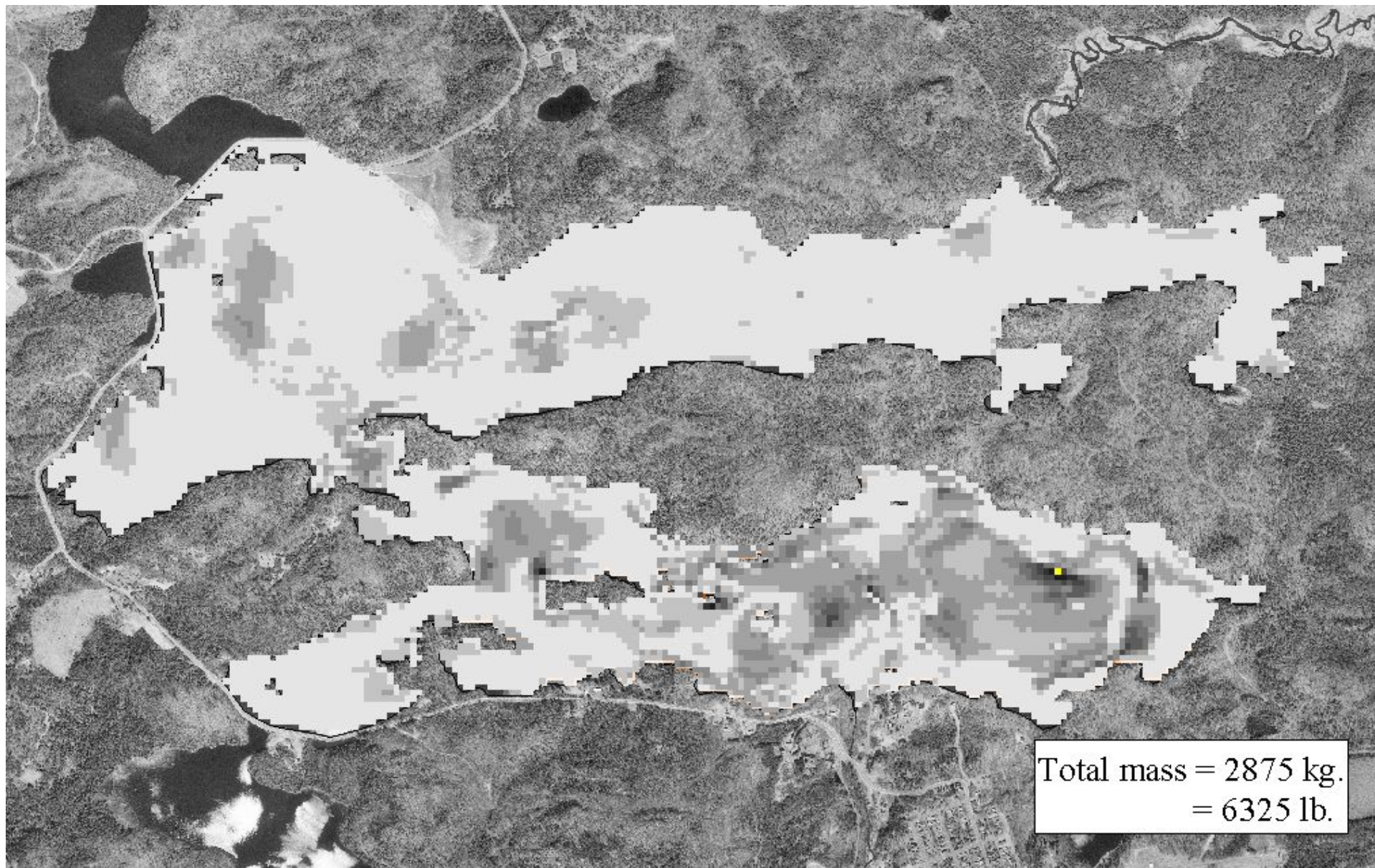
Close

☐ Retain the table used to create this report

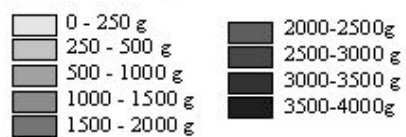
**Mass = Volume x Concentration x Density<sub>dry</sub>**

**Or, Mass = Volume x Concentration x Density<sub>wet</sub> x % Solids**





Sum of mass per 20x20 m cell



500 0 500 1000 Meters

Figure 15. Deer Lake: Estimated total mass (grams) per 20x20 meter grid cell for all layers of sediment. Mass was determined from interpolated concentration, percent solid, and wet density. Greatest mass is found in the south lake section. 28 March 2001



# Averaging Concentration Values



**Remediation**

**Remediation Zones Selection**

☐ Exposure unit or remediation unit

☒ Entire site

☒ Remediate to < AL

☐ Optimize remediation zone locations

**Parameters required to remediate to < AL**

Enter AL ( Action Level )

Ei Enter Expected Fill Material Concentration

**Output Data**

Beginning AL Average

End AL Average

Select Data

Run

OutPut Data

ArcView

Close

Block based

Site based

Remediation criteria

Before remediation  
PCB avg.

Expected after  
remediation PCB avg.



# Remediation zone scenarios (July 1999)

- 1997-98 dredged areas
- Remediation areas (10 ppm CUG, 1 ppm PRC)  
(17,418 cubic yards)
- Remediation areas (10 ppm CUG, 5 ppm PRC)  
(18,476 cubic yards)
- Remediation areas (10 ppm CUG, 10 ppm PRC)  
(20,368 cubic yards)

where CUG = Clean Up Goal  
PRC = Post-Remediation Concentration

## NOTE:

*Remediation areas increase in size as the PRC value increases since more PCB is left in place.*

IDW interpolation parameters:  
10 meter radius  
power of 4  
1 meter grid cell size



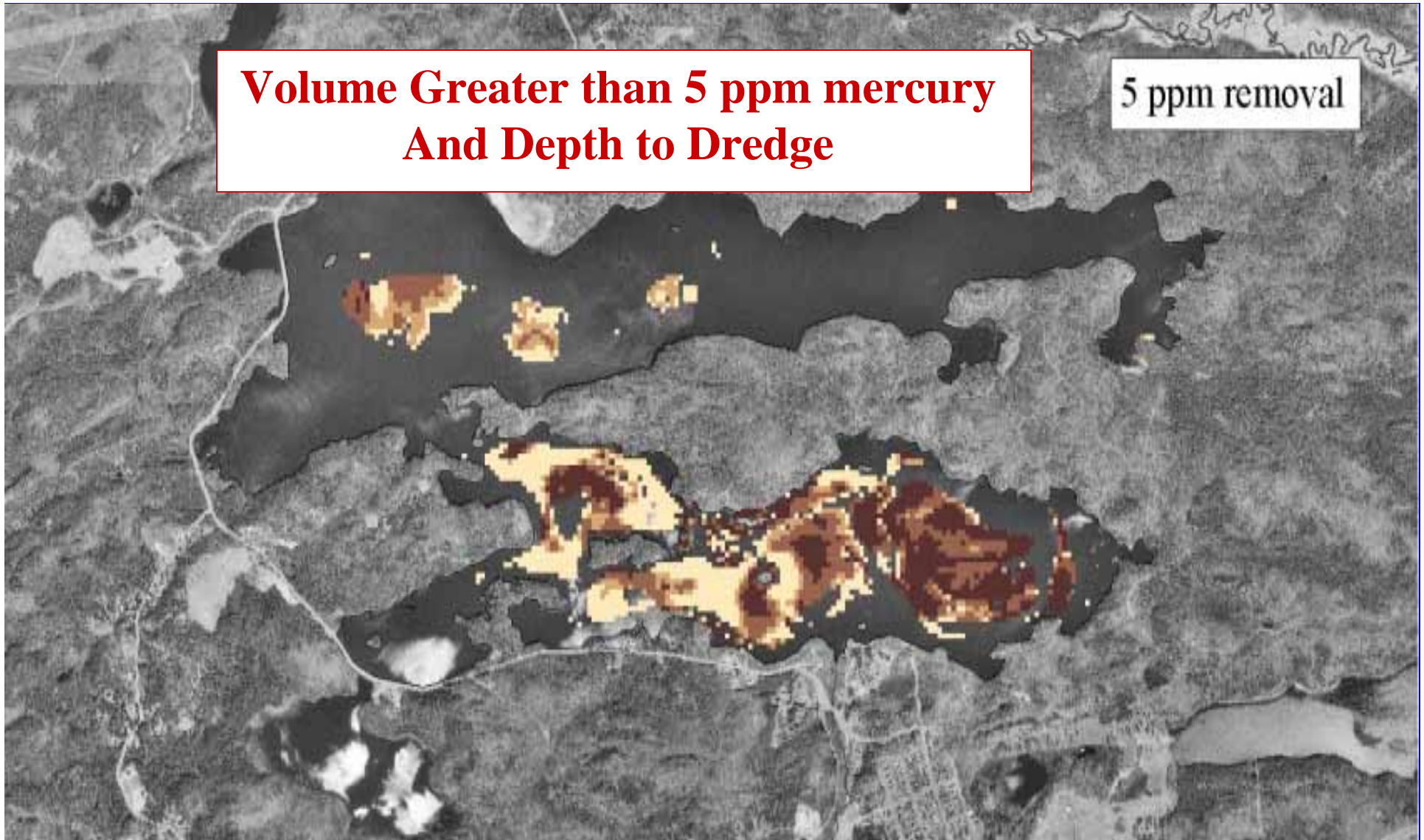
50 0 50 100 150 200 250 300 350 400 450 500 550 Yards

Manistique  
Harbor



# Volume Greater than 5 ppm mercury And Depth to Dredge

5 ppm removal



Depth to Dredge			
	0.5 ft		2 ft
	1 ft		3 ft

0 250 500 750 1000 Feet

Deer Lake: Estimated volume determination for removal of all sediment with a mercury concentration equal or greater than 5 ppm. Deeper contaminated sediments generally lay beneath contaminated sediment resulting overburden is estimated to be low. Grid size is 20x20 meter (400 sq m). 3D interpolation of concentrations were performed in earthVision (Dynamic Graphics Inc.) 8 Jan. 01

Depth to less than 5 ppm of mercury conc.	Volume of sediment (cubic yards)
0.5 ft	70,200 cy
1 ft	59,200 cy
2 ft	108,000 cy
3 ft	156,000 cy
<b>Total Volume</b>	<b>694,000 cy</b>



# 3 Dimensional Visualization

